

Cisco uBR7100 Series Universal Broadband Router



The best way for multi-unit businesses to build a broadband cable network today that offers fast Internet access and content delivery

The Internet has revolutionized the way we access information and obtain entertainment. As it becomes less expensive and more efficient to deploy high-speed networks, more opportunities will surface to add revenue around high-value Internet applications that let you immediately differentiate your services to customers and streamline operations. How do you take advantage of these innovations, increase profits, and build long term value for your business? The Cisco uBR7100 Series Universal Broadband Router is the key. The product lets you quickly and inexpensively build a broadband cable network today that supports high-speed Internet access and content delivery in one easy-to-use package designed for multi-unit (MxU) applications such as hotels, convention centers, high-rise apartments, shopping malls, and universities. The product saves you time and money in building the network.

Cisco uBR7100 Series at a Glance
 The Cisco uBR7100 Series Universal Broadband Router enables cost-effective, high-speed Internet access in the hospitality, multi-dwelling (MDU) and multi-tenant (MTU) market space using the existing coaxial cable already in a building. The Cisco uBR7100 Series requires exceptionally low

capital investment and minimal setup time to provide online Internet access. Figure 1 shows the product.

Figure 1: The Cisco uBR7100 Series Universal Broadband Router



Additionally, the Cisco uBR7100 Series works with the Cisco Building Broadband Service Manager (BBSM) system to provide an integrated, single-vendor MxU application bundle. Together, the Cisco uBR7100 Series Universal Broadband Router and the Cisco BBSM deliver a cable-based, in-building platform for plug-and-play Internet access, self-service activation, tiered service levels, and integrated billing for hassle-free customer service.

Will the Cisco uBR7100 Series serve you?

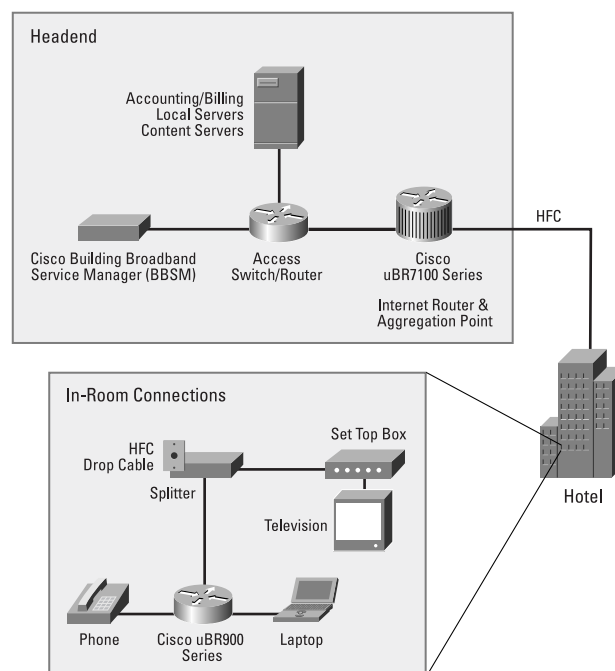
The Cisco uBR7100 Series Universal Broadband Router is designed to meet the demands of consumers who require faster and faster connections and more sophisticated services. The market includes:

- Multi-dwelling units (MDUs) such as high rise and garden-style apartments, townhouses, and condominiums; more and more, apartment renters and owners are demanding high-speed Internet connections to home offices. Owners or MDU associations can attract new buyers or renters by building an advanced cable IP infrastructure that offers secure, high-speed Internet access, along with cable TV service.
- Multi-tenant units (MTUs) such as commercial properties that house a number of small or medium-sized offices and that include shopping mall consortiums; such users can leverage the existence of a cable Internet Protocol (IP) infrastructure to:
 - Use a high-speed cable broadband medium for improved internal communications, including Local Area Network (LAN) services.
 - Develop businesses further and attract new opportunities and revenue streams through technological infrastructure advancements that improve the bottom line and through services that support IP data and Voice-over-IP (VoIP).

- Hospitality enterprises that include hotel and lodging properties and services, airports and convention centers; business travelers today demand high-speed connections to the Internet, as well as access to company intranets. Enterprises with large numbers of itinerant users are willing to spend money to support LAN-like performance and extend high-speed telecommuting to corporate users. Hospitality providers can build networks that offer such services in a flexible, affordable, and transparent manner. Applications include fast Internet access, e-mail, or virtual private network (VPN) pass-through services.
- Universities, colleges and research institutions that demand Internet and intranet connections; applications here may include distance learning, real-time imaging, shared “white board” and video conferencing. Broadband support means tomorrow’s students can log on to a class and watch the professor, while study notes appear on one side of the screen.

Depending on your needs, you can partner with an Internet service provider (ISP) or a cable operator to offer IP-based services. You can differentiate yourself from competitors, establish customer loyalty, and gain marketshare. Figure 2 depicts a hotel application.

Figure 2: Hotel Application



Hotels thrive or fail based on the quality of their customer care and accommodations. Emphasis on premium guest services is particularly important at the high end.

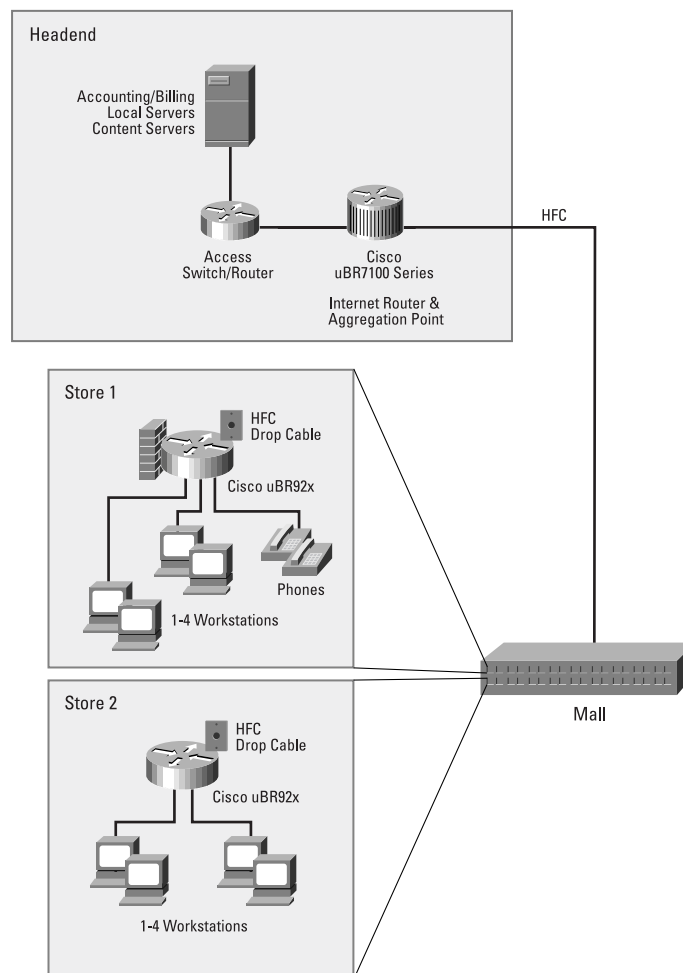
Corporate travelers and resort guests demand services and facilities that enrich visits. Corporate travelers often need to work from their hotel rooms, and thus, require Internet and intranet access—preferring to work as efficiently as if they were in the office.

Using the Cisco uBR7100 Series Universal Broadband Router to create a broadband cable network gives you the greatest economic advantage at the lowest cost. You can deliver hotel-specific content such as local advertising, offer automated registration/check-in, and support online payment which yields new revenues from increased

customer satisfaction and repeat visits. In a hotel application, the Cisco uBR7100 Series is typically installed as an on-premises mini-headend at an appropriate location such as a basement or wiring closet. Broadband cable connections join multiple rooms on multiple floors. In each room based on the services supported, a laptop and cable modem—the device that connects users to the Internet—as well as a set top box and TV can reside.

Figure 3 shows a shopping mall application. Shopping is already a proven Internet convenience. You can offer services that entice consumers to the mall and that converge online and offline retailing.

Figure 3: Shopping Mall Application



The Cisco uBR7100 Series can be installed as an on-premises mini-headend that supports high-speed services to improve the bottom line or deliver value-added

services to consumers. A full-service shopping center owner and property manager—specializing in shopping center development, financing, and property acquisition

and disposition—can build an IP cable broadband network that provides a variety of high-speed communications and interactive services to retailers within the mall. This enables retailers to offer the benefits of high-speed connectivity, using the latest data and video communications tools. Benefits are both external such as live fashion shows that enrich the mall visit; and internal benefits such as e-learning for new employee training, warehouse inventory checks and placement of orders to replenish stock, and improved closing of finances by linking retail outlets to headquarters.

Figure 4 depicts a convention center application. Competition to entice firms to hold meetings at a specific convention center is often fierce. One way to attract business and differentiate services is to offer an expanded list of Internet-based services. The Cisco uBR7100 Series can be installed as an on-premises mini-headend. Cable modems and PCs can be found in different meeting rooms. The figure shows how Internet and intranet access can be achieved in an extended office network environment that supports multiple meeting rooms.

Figure 4: Convention Center Application

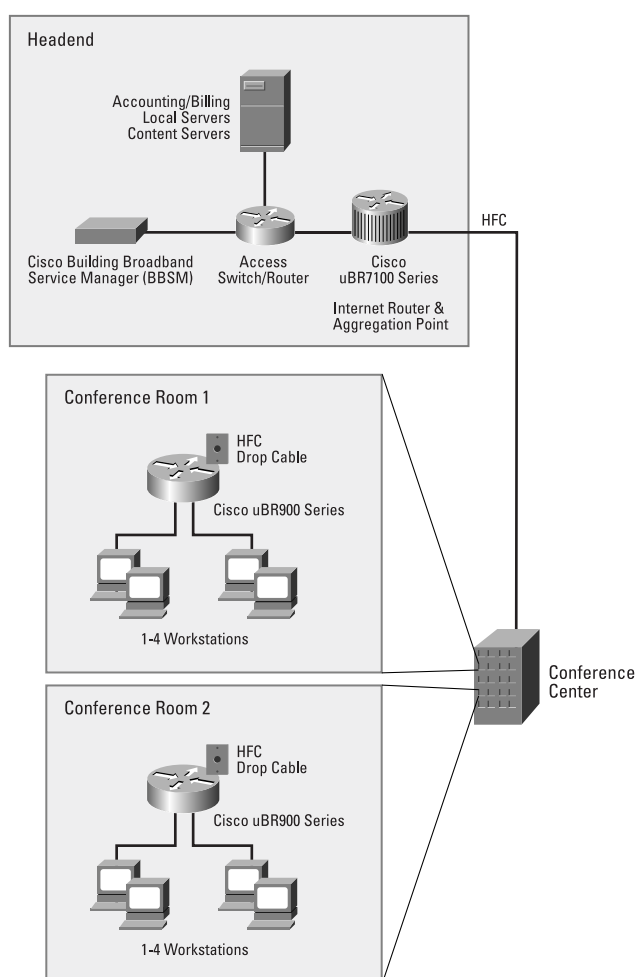
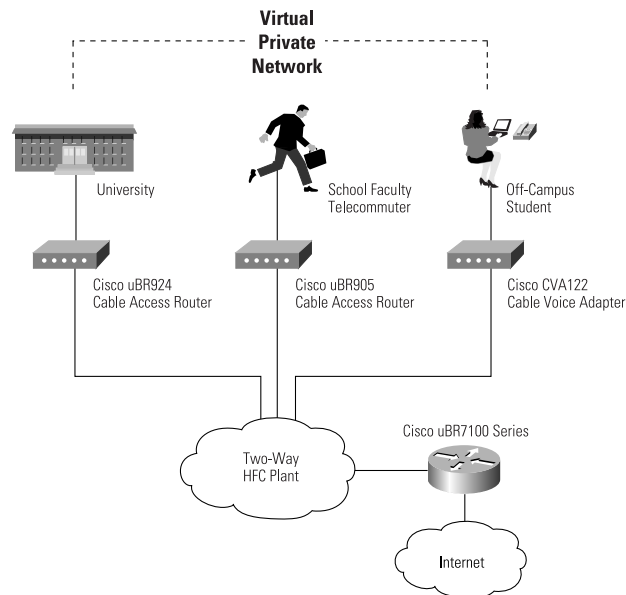


Figure 5, that follows, depicts a distance learning application. Broadband cable gives educational facilities the capability to support online, real-time education. Using multicasting technology, one professor can reach students at many different locations simultaneously. Multicasting involves sending broadcast messages, consisting of text, audio, and video, to a select list of

subscribers. In this application, the Cisco uBR7100 Series Universal Broadband Router serves as a headend. Cable modems and PCs typically reside at a university, remote telecommuter faculty location, or at an off-campus student residence.

Figure 5 shows differing Cisco cable CPE and enterprise devices such as the Cisco uBR905 Cable Access Router and the Cisco CVA122 Cable Voice Adapter.

Figure 5: Distance Learning Application



Cisco uBR7100 Series In Detail

With the Cisco uBR7100 Series, you can quickly construct an advanced digital broadband cable network that is well-suited to delivering high-speed Internet access and other IP services. The product leverages existing cable TV and telephone lines. The Cisco uBR7100 Series offers:

- Everything needed to build an on-premises mini-headend—the location that injects broadcast signals and enables data connectivity to and from customers. Known in the industry as a Cable Modem Termination System (CMTS), the Cisco uBR7100 Series Universal Broadband Router provides complementary functionality to cable modems. The product includes an integrated upconverter and modulator that converts data signals into a form that can be transmitted over a broadband cable network.
- An embedded network interface that serves as the high-speed backbone connection; the product comes with a dual 10/100 BaseT Ethernet network interface and supports one optional interface such as Ethernet, FE, serial, high speed serial interface (HSSI), ATM, or POS.

The Cisco uBR7100 Series Universal Broadband Router consists of the:

- Cisco uBR7111 and Cisco uBR7111E with one downstream port (from the headend to the remote user) and one upstream port (from the remote user to the headend)
- Cisco uBR7114 and Cisco uBR7114E with one downstream and four upstream ports

The Cisco uBR7111 and Cisco uBR7114 are CableLabs-qualified to DOCSIS 1.0 specifications. The Cisco uBR7111E and Cisco uBR7114E are tComLabs-qualified to EuroDOCSIS 1.0 specifications.

The product offers a CMTS and router in one box that:

- Provides centralized network intelligence and control
- Uses scarce network bandwidth efficiently, including options to engineer the network based on cable spectrum characteristics, as well as subscription, type of service, and desired service levels
- Supports the creation of new pricing models that allow usage-based billing and quality of service (QoS) options that guarantee consistent data-access speeds and improve the online experience to build increased customer loyalty

- Ensures security through DOCSIS and EuroDOCSIS Baseline Privacy (BPI) or options for managed customer premises equipment (CPE) such as authentication, authorization and accounting (AAA) server and router support
- Supports ease of installation; you can install the Cisco uBR7100 Series on a desktop or rack mount it. Because the product contains an upconverter/modulator that is integrated with the broadband cable line card interface, and because the product combines routing and CMTS functionalities, capital equipment expenditure is reduced.

The Cisco uBR7100 Series is based on the industry-leading Cisco uBR7200 Series Universal Broadband Router. The Cisco uBR7100 Series provides an alternative to the Cisco uBR7223 for small cable deployments. While the product is designed mainly for the MxU market space, the Cisco uBR7100 Series allows smaller cable operators to service small subscriber bases profitably and quickly. Because the product requires exceptionally low capital investment, it offers a superb value proposition that makes it financially attractive to offer broadband access to smaller markets that previously were not economical to service.

The Cisco uBR7100 Series supports a wide variety of applications. The product is evolving to support more advanced applications and services. Because the Cisco uBR7100 Series is designed with current and emerging standards in mind, you do not have to fear your network will become obsolete. The product interoperates with a wide variety of DOCSIS- and EuroDOCSIS-compliant vendor equipment, and therefore, offers the best alternative when delivering Internet access and other IP-based services to the MxU market.

Feature and Benefits

Cisco uBR7100 Series Universal Broadband Router Features and Benefits

Feature	Benefits
Complete package including a combined router and CMTS with an integrated upconverter and an embedded network interface in one platform	<ul style="list-style-type: none"> • Offers the lowest capital cost for an initial entry point with the most features • Minimizes overall cost of deployment • Reduces hardware costs • Includes tools to provision hosts/ CMs and supports property management systems (PMS) to quickly build and deploy a service-enabled broadband cable network today that generates immediate revenues
Standards-based	<ul style="list-style-type: none"> • Ensures operability with a wide-set of CMs • Protects investment
Easy deployment	<ul style="list-style-type: none"> • Allows single, centralized point of administration • Enables fast, reliable software upgrades
Reliable	<ul style="list-style-type: none"> • Ensures reliable service • Enables servicing to be quickly and easily performed, minimizing downtime and impact to the network
Advanced SNMP network management	<ul style="list-style-type: none"> • Enables identification of trouble areas before impacting customer service • Reduces response time in the event of a failure

Cost-Effective Integrated DOCSIS- or EuroDOCSIS-Based CMTS and Powerful Cisco IOS Software Router

The Cisco uBR7100 Series combines the functions of a traditional high-end router with a CMTS that contains an integrated upconverter—all, in a cost-effective product bundle. The Cisco uBR7100 Series leverages the proven Cisco uBR7200 Series and uses powerful Cisco IOS® Software. You benefit from the continual growth and enhancement of flagship Cisco hardware and software.

Standards-Based

The Cisco uBR7100 Series provides a standards-based platform. Product options let you install equipment today with the assurance that future technological improvements are accommodated.

Flexible, Easy-to-Use, All-Inclusive Product Design

The Cisco uBR7100 Series offers maximum flexibility. The product simultaneously supports two-way and telephone return on the same downstream channel based on the Cisco IOS software ordered.

The product supports Simple Network Management Protocol (SNMP) for standards-based network management. Other configuration options include telnet and serial access to the Cisco uBR7100 Series via a console or auxiliary port connection.

The Cisco uBR7100 Series ships with Cisco Network Registrar® version 3.5 at introduction. Cisco Network Registrar provides policy-based, robust, and scalable Domain Name System (DNS) and Dynamic Host Configuration Protocol (DHCP) services that form the basis for a complete cable modem or set top box provisioning system. Cisco Network Registrar is used both as a standalone product and as a component of the Cisco Subscriber Registration Center (CSRC).

The Cisco uBR7100 Series works with the Cisco Building Broadband Service Manager (BBSM) system which offers an integrated, single-vendor MxU solution. Together, the Cisco uBR7100 Series and the Cisco BBSM deliver a cable-based in-building platform that supports plug-and-play Internet access, self-service activation, tiered service levels, and integrated billing. The Cisco BBSM uses Network Address Translation (NAT) to connect static IP configurations and DHCP for dynamic configurations. The Cisco BBSM links to MxU property management systems (PMS) to support tiered services and remote port-by-port manageability.

Troubleshooting Tools and Commands

The Cisco uBR7100 Series supports troubleshooting with detailed traffic statistics by protocol and IP address. Troubleshooting commands available to diagnose problems include two key areas:

- Cable modems and the RF cable plant—Cisco uBR7100 Series software includes a flap list command that helps isolate problems between the cable plant (such as ingress noise or incorrect power levels) or specific cable modems. A flap is defined as a cable modem being registered on the CMTS, deregistering, and then immediately reregistering. With the flap list, you can quickly learn how to characterize trouble patterns in the network, determine which amplifier or feeder line is faulty, distinguish an upstream from downstream path problem and isolate an ingress noise impairment from a plant equipment problem.
- Transmission Control Protocol/Internet Protocol (TCP/IP)—The system supports tracing and debugging DHCP related messages on an administrator-defined CMTS network interface; tracing and debugging all Media Access Control (MAC) layer DOCSIS messages for a defined MAC address; monitoring specific processes through available debugging commands.

Traffic Shaping Mechanisms

The Cisco uBR7100 Series lets you specify policies to handle traffic exceeding bandwidth allocation. The product offers traffic-shaping capabilities to limit the data rate to and from a cable modem. Cable is a shared medium. Rate limiting ensures no single cable modem consumes all of the channel bandwidth.

Rate limiting also lets you configure different maximum data rates for cable modems. Users requiring higher peak rates and willing to pay for this can be configured with higher peak rate limits over others that do not require differentiated services.

The Cisco uBR7100 Series reduces the chance that data must be retransmitted to hosts on the cable plant. When rate limiting cable modems on the network, the Cisco uBR7100 Series software typically drops packets to enforce the rate limit. Dropping packets from a requesting cable modem causes the host sending the data to retransmit. Retransmitted data wastes bandwidth on the network. If both the hosts sending and requesting data are on the cable plant, the upstream bandwidth is wasted as well. The Cisco traffic shaping feature delays the scheduling of the upstream packet, which in turn causes the packet to be buffered on the cable CPE device instead of being dropped. This allows the user's TCP/IP stack to

pace the application traffic appropriately and approach throughput commensurate with the subscriber's defined QoS levels.

Guided and Scheduled Spectrum Management

The Cisco uBR7100 Series supports all DOCSIS and EuroDOCSIS error correction encoding, modulation types, and formats based on the router purchased. The DOCSIS and EuroDOCSIS RF specifications define the communications paths between the Cisco uBR7100 Series and the cable modems or set top boxes on the network. The Cisco uBR7100 Series includes options that let you specify different rules the system uses when encountering noise. Frequency hopping is one option in which upstream frequencies can be assigned as fixed or in a subband, and a hopping-decision criteria specified.

Reliability and Availability

The Cisco uBR7100 Series offers exceptional reliability, availability, and serviceability. A flash memory card enhances reliability by storing backup software images and configuration files. Environmental monitors offer levels of escalation so that you can take corrective action prior to system shutdown.

Supplemental Technical Information

What is a broadband cable network?

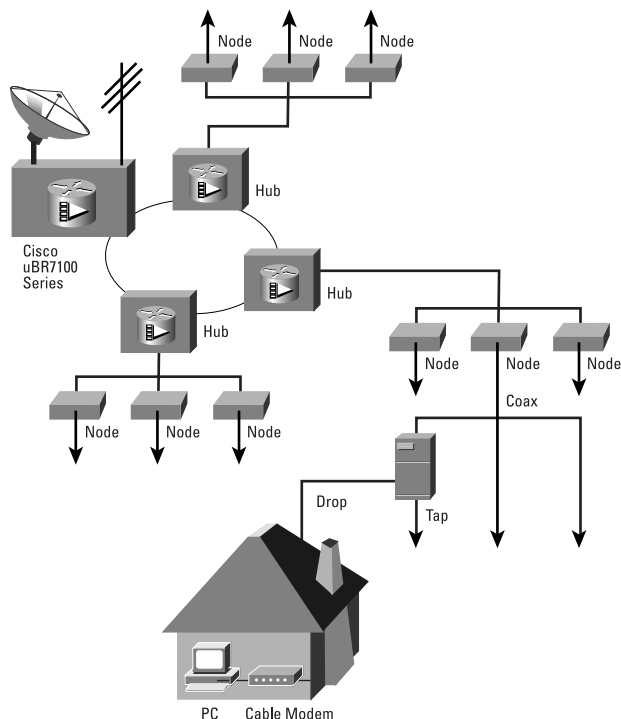
Broadband networking is among the fastest growing industries. Broadband networking opens the way to information, entertainment, and increased productivity. It allows businesses to link remote locations to a central site to unify operations or expand services to consumers. You can differentiate your services to consumers through a broadband cable network that consists of:

- A headend which receives and processes signals from various sources. The Cisco uBR7100 Series can serve as an on-premises mini-headend to enable high-quality television and IP-based service delivery. TV signals are electromagnetic impulses that occupy space in the frequency spectrum. They require some medium to travel or propagate. Broadcast cable TV signals, carried on a cable system, travel through special types of cable such as hybrid fiber coaxial (HFC) cable. Each TV signal travels on a different frequency inside the cable. Coaxial cable acts as a self-contained spectrum.

- Cabling:
 - Trunk cables carry the signal through a city, neighborhood, or vicinity
 - Distribution or feeder cables connect to the trunk cable and branch off to the remote areas served
 - Drop cables connect the distribution or feeder cable to the specific premises where the cables are attached to equipment
 - Terminal equipment—Consumer electronics that include cable modems, set top boxes, PCs, TVs, and other CPE; the function of a cable modem is to connect broadband—the cable TV network—to Ethernet. Cable modems modulate and demodulate signals. They can act as a modem, tuner, encryption/decryption device, bridge, router, Simple Network Management Protocol (SNMP) agent, or Ethernet hub.
- Ethernet cards are typically found in PCs. Once an Ethernet card is installed, TCP/IP software is installed on the PC to support connectivity. TCP is a protocol used to control the rate of information transfer and ensure reliable delivery of data between two computers. The protocol controls the rate or flow at which data is transmitted between computers.

Figure 6 that follows depicts a typical cable broadband network. High-speed IP data services can be packaged, along with cable TV service. Channel capacity can be allocated to support digital data between IP hosts and connected subscribers—those accessing the network to communicate or avail themselves of the services the network offers.

Figure 6: Typical Broadband Cable Network



A two-way, bidirectional network supports transmission to and from the headend over HFC in both directions. In the downstream direction, digital data is modulated and placed on a TV carrier. Supported modulation schemes include Quadrature Phase Shift Keying (QPSK) and Quadrature Amplitude Modulation (QAM). For DOCSIS North American channel plans, this means a 6 MHz channel between 52 to 860 MHz. For EuroDOCSIS Phase Alternating Line (PAL) and Systeme Electronique Couleur Avec Memoire (SECAM) channel plans, this means an 8 MHz channel between 85 and 860 MHz. The digital data signal is placed in a 6 or 8 MHz channel adjacent to TV signals based on the Cisco uBR7100 Series Universal Broadband Router purchased.

The upstream direction is trickier. In a two-way cable architecture, the upstream tends to be noisy with interference from home appliances, loose connectors, or poor cabling. All noise travels upstream, combining and increasing.

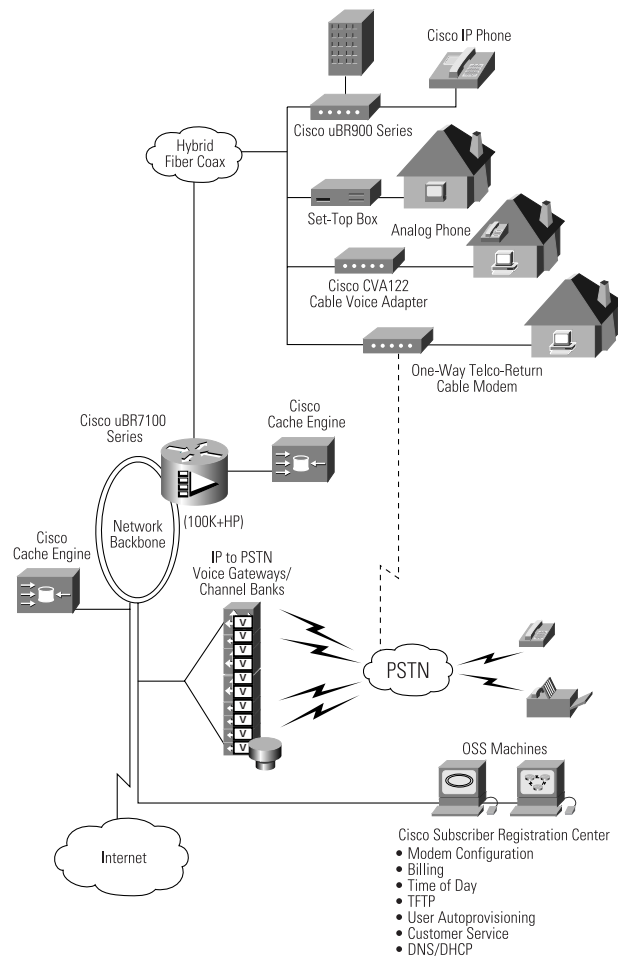
The Cisco uBR7100 Series gives you the choice of modulation schemes. The importance of the data, combined with cable characteristics, determine the

modulation scheme to use to ensure reliable transfer. QPSK is more robust and provides a higher order modulation technique, but is slower than QAM.

The Cisco uBR7100 Series Universal Broadband Router supports transmission over cable networks that are not yet two-way capable. Figure 7, that follows, depicts a sample DOCSIS configuration.

Upstream connections are over standard telephone lines. The Cisco uBR7100 Series provides downstream data from the cable line card and accepts upstream traffic via a combination of the local Public Switched Telephone Network (PSTN) and the IP network path that terminates at the router. Upstream data is through a telco-return modem (external or internal to a cable modem based on the third-party vendor).

Figure 7: Typical Telephone Return Configuration



What is the significance of DOCSIS and EuroDOCSIS?

DOCSIS and EuroDOCSIS are international standards that many cable products comply with. The standards ensure that interoperable, multiple-sourced headend and cable modem products are delivered to market that work together. DOCSIS and EuroDOCSIS is based on IP packets—the native format of the Internet. DOCSIS and EuroDOCSIS support mechanisms that promote multi-tiered Internet access and interactive cable modem and set top box data and control. The standard provides QoS capabilities to differentiate data and VoIP service offerings.

DOCSIS and EuroDOCSIS standards evolve through a proposal and approval process between the DOCSIS or EuroDOCSIS community. The community includes cable

operators, vendors, and Internet service providers (ISPs). Many cable operators, networking companies, cable equipment manufacturers, consumer electronics and modem companies support the DOCSIS and EuroDOCSIS standards. Adherence to these standards ensure that products scale and interoperate to enable advanced services such as high-speed data via a cable modem, digital TV, video on demand, and cable telephony. This gives you freedom of choice. The move to a standards-based approach lowers costs, increases reliability, and facilitates the rapid deployment of new services.

Disparate solutions that are not standards-based inherently lack scalability. A network of many elements, separately managed that does not interoperate, creates a complex network and skyrockets operational costs.

Though products might meet your needs today, they will likely not scale once you expand your network to support increased services and attempt to penetrate more new markets.

Because cable already exists in most areas and consumers demand immediate high-speed Internet access, broadband cable is being propelled to the forefront. With broadband cable, fiber optic rewiring, costly T1 leased lines, or digital subscriber line (DSL) installations are not required.

You can use the Cisco uBR7100 Series Universal Broadband Router to quickly build a broadband cable network today that works with an existing infrastructure. The product sustains downstream and upstream traffic to and from a wide-variety of DOCSIS and EuroDOCSIS compliant two-way or one-way cable modems and set top boxes.



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